Math 104B: Introduction to Numerical Analysis Spring 2023

INSTRUCTOR Paul J. Atzberger
http://atzberger.org/

Office Hours: MWF 9:50am – 10:50am
Location: SH 6712.

CLASS TIMES MWF 9:00am – 9:50am
Phelps 1425

DESCRIPTION Numerical approaches play an important role in many fields including in scientific research, engineering, finance, machine learning, and data analysis. This class will discuss both mathematical foundations and practical use of modern numerical methods. Examples also will be discussed from related applications areas. More information can be found on the course website.

PREREQUISITES Calculus, Linear Algebra, Differential Equations, and experience programming.

TEXTBOOKS *Numerical Analysis 10th Edition* by R. L. Burden and J. D. Faires.

GRADING

Homework/Quizzes	30%
Midterm	30%
Final Exam/Project	40%

POLICIES Assignments will be assigned in class and posted on the course website. Prompt submission of homeworks will be required. While no late homework will be accepted, one missed homework will be allowed without penalty. While it is permissible for you to discuss materials with classmates, the submitted homework must be your own work.

There is a policy of no video or pictures to be taken during lectures. Instead, one should take notes and pay particular attention. There is also a policy of no texting, e-mailing, or social media during the class. It is hoped one is avoiding such distractions to make the most of the class.

EXAMS A midterm exam will be on Wednesday, May 17.
Final exam/project.

TOPICS sample of topics

- Initial-Value Problems for Ordinary Differential Equations
  - Well-posedness of initial-value problems.
  - Euler's Method of Approximation.
  - Taylor Methods for Higher-order Approximation.
  - Runge-Kutta Methods.
  - Multistep Methods.
  - Convergence Analysis.
  - Order of Accuracy and Stability.
  - Stiff Differential Equations.

- Solving Linear Systems and Matrix Algebra
  - Linear Algebra Review.
  - Linear Equations.
  - Direct Methods.
  - Gaussian Elimination and Pivoting Strategies.
  - Matrix Factorizations.
  - Iterative Methods.
  - Eigenvalues and Eigenvectors.
  - Power Method.
  - Approximate Solution of Linear Systems.
  - Jacobi Iteration and Gauss-Siedel Iteration.
  - Rates of Convergence.
  - Conjugate Gradient Method.
  - Preconditioners.
  - Multigrid Methods.
- Application Areas
  - Engineering and the Sciences.
  - Statistical Inference, Machine Learning, Data Science.
  - Computer Graphics and Visualization.
  - Financial Modeling and Economics.

See the website for additional topics and information.

WEBSITE http://teaching.atzberger.org/